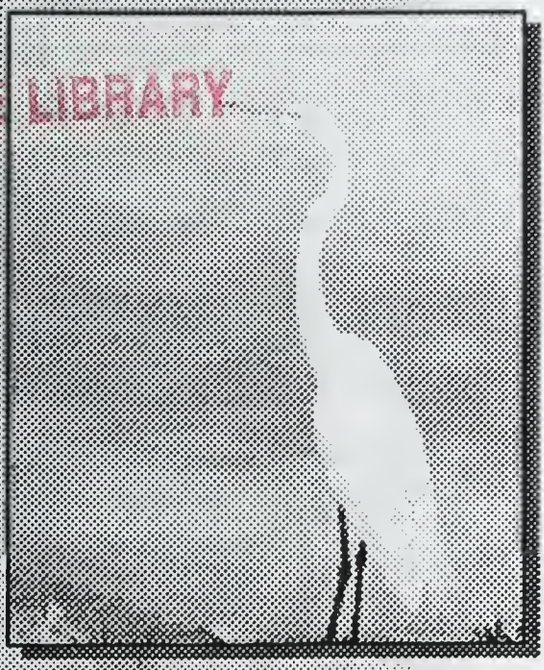
I333.91
SEPT
c.3
41458443

Septic Systems and Their Impacts on Wetland Environments

ILLINOIS DOCUMENTS
APR 07 1999
ILLINOIS STATE LIBRARY



UNIVERSITY OF ILLINOIS-URBANA
3 0112 120227639

Illinois Department of
Natural Resources

Septic Systems and Their Impacts on Wetland Environments

Many developers, regulators and homeowners view septic systems as an efficient and cost-effective means to deal with domestic sewage, but few are aware of the potential ecological hazards septic systems may pose. Minimum regulations for septic systems are prescribed by the state of Illinois and local health departments. While many existing septic systems near wetlands and aquatic environments meet current regulations, the quality of wetlands and aquatic ecosystems are being affected.

Selected References

Alhajjar, B.J., Chesters, G., Harkin, J.M. 1990. Indicators of Chemical Pollution from Septic Systems. *Ground Water*, v. 28, p 559-568.

Bigari, D. 1994. Is the Grass Always Greener Over Your Septic Tank? *Wellspring*, v. 3, p. 1-5.

Bradof, K., Hutzler, N. 1995. The Joys of Rural Life-The Headaches of Wastewater Disposal. *Wellspring*, v. 4, p.1-6.

Izuno, F.T., Sanchez, C.A., Coale, F.J., Bottcher, A.B., Jones, D.B. 1991. Phosphorous Concentrations in Drainage Water in the Everglades Agricultural Area. *Journal of Environmental Quality*, v. 20, p 608-619.

Laak, R., 1986. Wastewater Engineering Design for Unsewered Areas, Lancaster, Pa: Technomic Publishing Co. Inc.

Panno, S.V., Nuzzo, V.A., Krapac, I.G., Hensel, B.R., Cartwright, K. 1995. Changes to the Chemical Composition of Groundwater in a Fen-Wetland Complex Caused by Urban Development. *Wetlands* (submitted).

Patterson, J.W., Minear, R.A., Nedved, T.K. 1971. Septic Tanks and the Environment. *Illinois Institute for Environmental Quality*: 71-2. Springfield, Ill.

Postma, F.B., Gold, A.J., Loomis, G.W. 1992. Nutrient and Microbial Movement from Seasonally Used Septic Systems. *Journal of Environmental Health*, v. 55, p. 5-10.

Welch, E.B. 1992. Ecological Effects of Wastewater, Applied Limnology and Pollutant Effects. Second Edition, New York: Chapman & Hall (1992).

The Illinois Department of Natural Resources receives federal financial assistance and therefore must comply with federal anti-discrimination laws. In compliance with the Illinois Human Rights Act, Illinois Constitution, Title VI of the 1964 Civil Rights Act, Section 504 of the Rehabilitation Act of 1973 as amended, and the U.S. Constitution, the Illinois Department of Natural Resources does not discriminate on the basis of sex, color, race, religion, national origin, age or disability. If you believe you have been discriminated against in any program, activity or facility, please contact the Equal Employment Opportunity Officer, Illinois Department of Natural Resources, 524 S. Second St., Springfield, IL 62701-1787, (217) 785-0067 or the Office of Human Resources, U.S. Fish & Wildlife Service, Washington, DC 20240.

Illinois Department of Natural Resources information is available to the hearing impaired by calling DNR's Telecommunications Device for the Deaf at (217) 782-9175.

Printed by Authority of the State of Illinois — Printed on Recycled Paper Stock

December 1998

To request additional copies of this publication, please contact the Illinois Department of Natural Resources, Information Clearinghouse, 524 S. Second St., Springfield, IL 62701-1787 (217) 782-7454, fax (217) 782-9552, TDD (217) 782-9175

Illinois Department of Natural Resources

3 0112 120227639

UNIVERSITY OF ILLINOIS-URBANA

ILLINOIS STATE LIBRARY

APR 0 7 1999

ILLINOIS DOCUMENTS

1333.91
SEPT
c.3

4/14/58 4/43

Septic Systems and Their Impacts on Wetland Environments

Function of Septic Systems

A conventional septic system has three main components: a tank, distribution piping and the surrounding soil. The size of the tank is dependent upon household size and predicted amount of use. The system will not function properly if the tank installed is too small to handle the amount of waste entering it. As household waste is flushed or drained, it enters the tank, where most of the solids settle to the bottom. The organic solids are then digested by bacteria to form a sludge which needs to be pumped out periodically. The liquid waste leaves the tank by way of a pipe and is distributed to the absorption field and surrounding soil. As this liquid percolates through the soil, biological, chemical and physical processes complete the on-site treatment.

Main components of a septic system include a tank, distribution piping and the absorption field (surrounding soil).

Movement of Septic Effluent

If proper conditions for treatment are not present, groundwater, surface water and human health problems arise. As partially treated wastewater reaches the absorption field and surrounding soil of a septic system, it begins to percolate toward the water table by way of gravity. If conditions are suitable, pathogenic bacteria are removed and nutrients from household wastes are absorbed. In unsuitable conditions, septic effluent containing these excess nutrients and bacteria can drain directly into a wetland or may move to the water table before it is properly treated. If it reaches the water table, it can then drain into a wetland or infiltrate an aquifer that may be a drinking water supply. Although there are many potential contaminants in domestic sewage, phosphates, nitrogen and salt are the most common chemical contaminants, and increased levels entering any aquatic ecosystem can have adverse effects.

Most wetlands are recharged by groundwater as well as surface runoff and precipitation. If the groundwater contains septic effluent, it can contaminate nearby wetlands.

Phosphates

The main sources of phosphates in septic effluent are human waste and cleaning detergents. Although many manufacturers of detergents have eliminated phosphates in their products, they are still widely used. Movement of phosphates through the natural environment is usually limited; however, a failing septic system with a surface discharge can provide a direct route for contamination of aquatic systems. Increased concentrations of phosphates continually discharged into a lake over a period of time can play a role in accelerated eutrophication (aging). Since phosphates are usually the limiting growth factor in aquatic ecosystems, excess amounts entering the system will lead to an explosion of cattail and algal growth. When excess amounts of phosphate-dependant algae are decomposed, oxygen is depleted. In a worst-case scenario this will cause the death of all the oxygen-dependent animals within the lake.

Nitrogen

Nitrogen in septic effluent is usually found in organic and ammonia forms from human waste. As septic effluent is treated, these forms of nitrogen are converted to nitrate (nitrification), which in excess amounts is toxic to animals as well as humans. Nitrification contributes to the creation of an acidic condition by lowering the pH of the septic effluent. Acidic effluent can significantly alter the chemistry of a sensitive wetland ecosystem and affect chemical and biological processes of the organisms within the system. Increased acidity can also increase the solubility of metals. (Although metals are not usually found in high concentrations in household waste, they pose a significant hazard to living organisms, as even small amounts of metals can be toxic.)

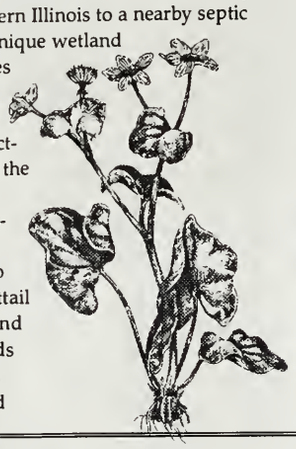
Nitrates as well as phosphates can contribute to the increase in biological oxygen demand within an aquatic ecosystem. As the organic material is decomposed, oxygen is utilized.

The spotted turtle is listed as endangered in Illinois. Because this species tends to avoid dense cattail stands, maintaining good water quality and native plant compositions in the sedge meadows, fens and marshes it inhabits is important.

Salt

Sodium chloride (table salt) is usually found in high concentrations in human waste; levels are dependent upon dietary intake and amounts present in household water. As sodium chloride is released into the natural environment it becomes extremely mobile. Salt from even a normally functioning septic system can be the single most damaging element to a wetland; since biological systems utilize only small amounts of salt, nearby wetlands can act as a salt "sink" by accumulating large concentrations.

Recent studies by the Illinois State Geological Survey linked the overall decrease in biodiversity of a fen in northeastern Illinois to a nearby septic system. A fen is a unique wetland complex that receives most of its water from the surrounding watershed, reflecting the chemistry of the underlying geology. Unique plant ecosystems supported by fens have adapted to this chemistry. A cattail species typically found in disturbed wetlands and only in margins of fens was observed replacing the unique fen vegetation in areas where salt concentrations were excessive. The plume of septic effluent was visibly traced by the presence of this salt-tolerant species. Even a seemingly small amount of disturbance, such as the effluent from a single septic system, can disturb the biological communities supported by a groundwater recharged wetland.



Caltha palustris (Marsh Marigold).

Marsh marigolds grow in fens and other wetlands where groundwater is discharged at the surface. It has adapted to a specific water chemistry, and can be out-competed by more aggressive species such as the narrow-leaf cattail when water chemistry changes.

Sedimentation

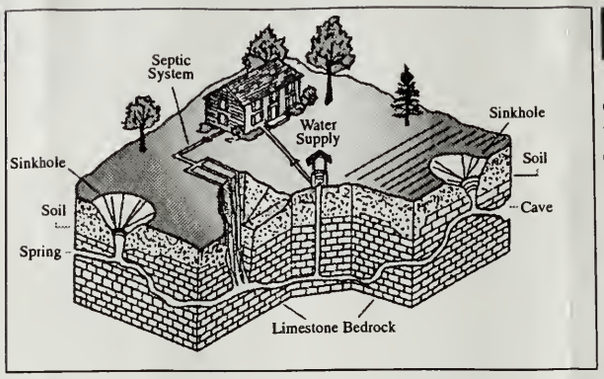
A failing septic system with a surface discharge may not be filtering out all solids contained in the effluent before it reaches an aquatic ecosystem. This organic material not only contains excess nutrients and toxins, but also can increase the turbidity (cloudiness) of an aquatic ecosystem. High turbidity can reduce the amount of sunlight that would normally penetrate certain depths in the water. This will inhibit normal plant growth, thus less oxygen will be available. Large amounts of sediment can also be deposited on aquatic insect larvae and fish eggs, reducing the normal oxygen levels, and leading to increased mortality.

Seasonal Lake Homes

Septic systems surrounding a lake can be particularly harmful when the homes are only used seasonally. Studies have shown that the absorption field of a typical septic system in sandy soils needs to have a clogging mat (a layer of beneficial bacteria) to properly treat the effluent. If a clogging mat is not allowed enough time to be formed, as a result of only seasonal use of lake homes, the septic effluent is not being treated as well as it should be.

Karst Topography

Although karst topography is not necessarily associated with wetlands, special note should be made for placing septic systems in karst terrain (found throughout portions of western and southern Illinois), as this type of land is one of the least suitable for treating septic effluent. Karst either consists of limestone or dolomite, and has many sinkholes, crevices and cavities that lead to underground streams and springs. Surface water not lost to evaporation drains into the surrounding



sinkholes or infiltrates the crevices in the bedrock, and eventually leads to a unique aquatic cave community, spring and/or a source of drinking water. Septic effluent will follow the same path as surface water. Since karst terrain is not conducive to proper treatment of household waste, sensitive aquatic communities that lie beneath the surface are affected by septic effluent.

Soils

The most expensive, state-of-the art septic system will not sufficiently treat household waste if the proper conditions are not present. Some soils in Illinois are completely inadequate for treating septic effluent, yet septic systems are repeatedly being installed in them. Soil survey books, published by the USDA- Natural Resource Conservation Service, are available for most counties in Illinois. These books depict soil types present within the county and describe the suitability or limitations of each type for the placement of septic systems. State regulations require either soils evaluation or percolation tests before any type of treatment system is installed. The table below illustrates various limitations related to the placement of septic systems. The ideal soil composition for proper treatment consists of an even mixture of sand, clay and silt.

Regulations

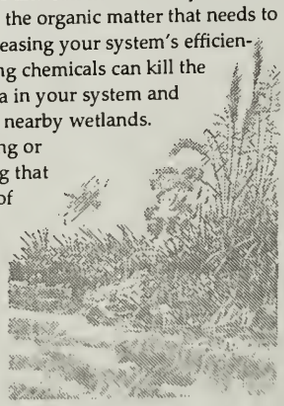
The Illinois Private Sewage Disposal Code, administered by the Illinois Department of Public Health and local county health departments, requires minimum standards for septic systems. A few counties in Illinois have enacted regulations that are more stringent than the state code. The code is intended to ensure proper installation occurs to minimize human health threats and general environmental concerns, however, they do not necessarily prevent degradation of sensitive aquatic ecosystems. While a septic system may operate under optimum conditions and meets all state and/or county requirements, adverse impacts to aquatic systems may still occur. When considering the development of sites with unique aquatic or geological features, local regulators responsible for approving new homesites and subdivision plats need to be aware of the limitations of septic systems regulations and utilize their authorities to ensure the unique resources are protected.

Various conditions of septic fields that may contribute to septic system failure.

Potential Limitations	Reasons For Failure
Large amount of sand and gravel in soil	Percolates too quickly; little treatment
Large amount of clay or silt in soil	Ponding; effluent will accumulate at top of septic field
Shallow soils	Effluent may accumulate on bedrock untreated and eventually reach water supply
High water table	Direct contamination of water supply
Steep slopes	Uneven distribution
Small lot sizes	Surrounding soils cannot assimilate high-density of septic systems
Wetland present	Hydric soils are unable to properly treat effluent
Karst terrain	Effluent can directly enter shallow aquifer w/little or no treatment

What you can do

- Consult with your local health department or county soil and water conservation district to learn which treatment methods best suit the conditions on your property.
- When installing your septic system, maximize the amount of space separating the system from a wetland or waterbody. This will allow a greater treatment area for the effluent before it reaches poor-treatment conditions.
- A woody strip or "green belt" along the edge of a wetland will intercept and use some of the nutrients before they reach the wetland. However, trees and shrubs should be kept from growing near the absorption field to prevent roots from entering the system.
- Check the level of sludge accumulating in your tank at least every 2-3 years. Proper maintenance not only saves you money by lengthening the life of your system, it can also prevent unnecessary degradation of your environmental surroundings. Pumping usually costs under $100; having your system replaced will cost you thousands of dollars.
- Have your private well water tested annually. Excess nitrogen and chloride found in your drinking water are indicators of a failing system.
- Do not use cleaning agents that contain phosphates. The labels on most cleaning detergents will indicate their presence.
- Do not use products that claim to clean your septic system. The compounds contained in the "cleaners" may decrease the efficiency of your system by killing the microorganisms that treat the effluent. Other products that contain enzymes and bacteria have not proven to be effective, and should never be considered a replacement for pumping.
- Conserving water will also increase the efficiency of your system, by allowing the wastes to be treated longer. Install water-saving appliances, or conservation devices on shower heads, toilets and faucets.
- Do not treat the soil absorption field like just another area of your lawn; it is the most important component of your septic system. Do not allow excessive water to be drained onto it; it will become overloaded and unable to properly treat wastes. Cars, and other heavy objects should be kept clear of the absorption field; the weight will compact the soil, inhibit proper water flow, and may even crack the pipes.
- Do not saturate the absorption field. Avoid heavy lawn-watering; do not pile snow over the absorption field. Directing surface drainage away from the absorption field will prevent saturation and increase the system's efficiency.
- Do not fertilize near the absorption field; excess nutrients and organic matter can "overload" the surrounding soil.
- Be aware of what is entering your system and what may decrease its efficiency. Liquid fabric softeners can result in excessive scum in your tank. Grease and other items discarded in a garbage disposal can clog the pipes and soil in the absorption field, and will increase the organic matter that needs to be digested, decreasing your system's efficiency. Harsh cleaning chemicals can kill the beneficial bacteria in your system and also contaminate nearby wetlands.
- Avoid flushing or draining anything that can be disposed of in another way.



We wish to thank ***Dr. Robert Mohlenbrock*** *for his permission to use the marsh marigold drawing from his Illustrated Flora of Illinois: Magnolias to Pitcher Plants, printed by the Southern Illinois University Press.*

We also wish to acknowledge ***Samuel Panno****, of the Illinois State Geological Survey, whose research and input have been instrumental in the development of this publication.*

Selected References

Alhajjar, B.J., Chesters, G., Harkin, J.M. 1990. Indicators of Chemical Pollution from Septic Systems. *Ground Water*, v. 28, p 559-568.

Bigari, D. 1994. Is the Grass Always Greener Over Your Septic Tank? *Wellspring*, v. 3, p. 1-5.

Bradof, K., Hutzler, N. 1995. The Joys of Rural Life-The Headaches of Wastewater Disposal. *Wellspring*, v. 4, p.1-6.

Izuno, F.T., Sanchez, C.A., Coale, F.J., Bottcher, A.B., Jones, D.B. 1991. Phosphorous Concentrations in Drainage Water in the Everglades Agricultural Area. *Journal of Environmental Quality*, v. 20, p 608-619.

Laak, R., 1986. Wastewater Engineering Design for Unsewered Areas, Lancaster, Pa: Technomic Publishing Co. Inc.

Panno, S.V., Nuzzo, V.A., Krapac, I.G., Hensel, B.R., Cartwright, K. 1995. Changes to the Chemical Composition of Groundwater in a Fen-Wetland Complex Caused by Urban Development. *Wetlands* (submitted).

Patterson, J.W., Minear, R.A., Nedved, T.K. 1971. Septic Tanks and the Environment. *Illinois Institute for Environmental Quality*: 71-2. Springfield, Ill.

Postma, F.B., Gold, A.J., Loomis, G.W. 1992. Nutrient and Microbial Movement from Seasonally Used Septic Systems. *Journal of Environmental Health*, v. 55, p. 5-10.

Welch, E.B. 1992. Ecological Effects of Wastewater, Applied Limnology and Pollutant Effects, Second Edition, New York: Chapman & Hall (1992).

The Illinois Department of Natural Resources receives federal financial assistance and therefore must comply with federal anti-discrimination laws. In compliance with the Illinois Human Rights Act, Illinois Constitution, Title VI of the 1964 Civil Rights Act, Section 504 of the Rehabilitation Act of 1973 as amended, and the U.S. Constitution, the Illinois Department of Natural Resources does not discriminate on the basis of sex, color, race, religion, national origin, age or disability. If you believe you have been discriminated against in any program, activity or facility, please contact the Equal Employment Opportunity Officer, Illinois Department of Natural Resources, 524 S. Second St., Springfield, IL 62701-1787, (217) 785-0067 or the Office of Human Resources, U.S. Fish & Wildlife Service, Washington, DC 20240.

Illinois Department of Natural Resources information is available to the hearing impaired by calling DNR's Telecommunications Device for the Deaf at (217) 782-9175.

Printed by Authority of the State of Illinois Printed on Recycled Paper Stock
December 1998

To request additional copies of this publication, please contact the Illinois Department of Natural Resources, Information Clearinghouse, 524 S. Second St., Springfield, IL 62701-1787 (217) 782-7454, fax (217) 782-9552, TDD (217) 782-9175